Technical Management Team
2005 Year End Review

Water Quality

Fixed Monitoring Stations

- Corps operated a total of 29 FMS's
  - ⇨Portland District: 8 Stations
  - ⇨Walla Walla District: 16 Stations
  - ⇨Seattle District: 5 Stations
- Bureau of Reclamation Operated 4 FMS's
- Mid-C PUD's Operated 10 FMS's
- 5 New Stations in 2005
  - ⇨Relocated Forebay Stations at LWG, LGS, LMN, IHR, and MCN (Washington Side).
- Data can be obtained at "Dataquery"
  - ⇨ http://www.nwd-wc.usace.army.mil/perl/dataquery.pl

Total Dissolved Gas

Project	Start of Spill	End of Spill	Days of Spill
Lower Granite	20 June	31 August	73 Days
Little Goose	20 June	31 August	73 Days
Lower Monumental	20 June	31 August	73 days
Ice Harbor	7 April	31 August	147 days
McNary	20 June	31 August	73 days
John Day	10 April	31 August	144 days
The Dalles	11 April	31 August	143 days
Bonneville	15 April	31 August	139 days

Total Dissolved Gas

Comparison of Exceedences with Previous Years TDG Exceedences from High 12-hr Average in 24 hours				
Year	Days in Spill Season	Number of Days Exceeded	Percent Exceeding TDG Standard (%)	Percent Consistent with TDG Standard (%)
2005	3020	69	2.3	97.7
2004	3020	71	2.4	97.6
2003	3020	243	8.0	92.0
2002	3020	490	16.2	83.8
2001	3020	13	0.4	99.6
2000	3020	252	8.3	91.7
1999	3020	411	13.6	86.4
Ave.	**3020**	**247**	**8.17**	**91.8**

Total Dissolved Gas

TYPES OF EXCEEDANCES FOR 2003 - 2005 SPILL SEASONS				
2005	**2004**	**2003**	**TYPE #**	**DEFINITION**
11	4	68	1	Exceedance due to high runoff flows and flood control efforts.
0	0	0	2	Exceedance due to Intertie line outages.
0	0	0	3	Exceedance due to unit outages during repair or maintenance.
3	0	0	4	Exceedance due to BPA inability to handle load so water was spilled.
0	0	1	5	Exceedance due to a break down in communication. Teletype went out but no change occurred or Project operator interpreted teletype differently than what was intended.
32	16	106	6	Exceedance due to uncertainties when using best professional judgment to apply the spill guidance criteria (travel time; degassing; water temperature effects; spill patterns).
15	0	18	7	Exceedance due to high TDG levels coming from the Mid Columbia River Dam (see Pasco FMS readings).
0	3	0	8	Exceedance due to high TDG levels coming from the Snake River projects (see Ice Harbor Dam FMS readings).
0	0	0	9	Exceedance due to a load rejection. The powerhouse was not working and the river was spilled.
1	6	7	10	Exceedance due to lack of information: the FMS gage malfunctioning and we had no information at the time of making spill change decisions.
0	0	9	11	Exceedance due to mechanical problems (gate was stuck open, passing debris etc.).
7	25	20	12	Exceedance due to sharp rise in water temperature (a 3 to 5 degree F. change in a day).
0	7	33	13	Exceedance due to bulk spill pattern being used which generated more TDG than expected.
0	10	0	12/7	Exceedance due to combination of exceedance type 12 and 7.
69	**71**	**262**		**Totals**

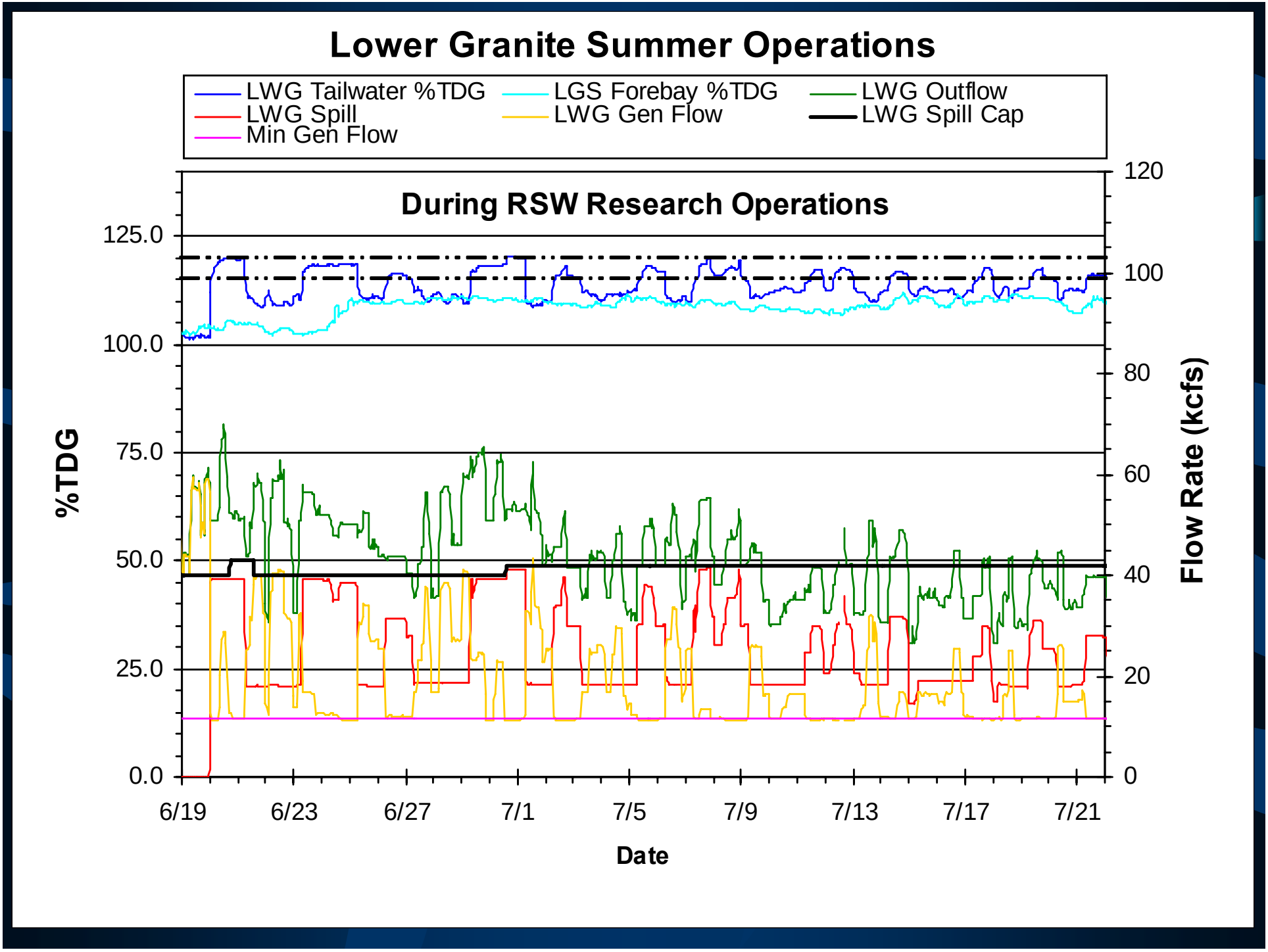
Total Dissolved Gas

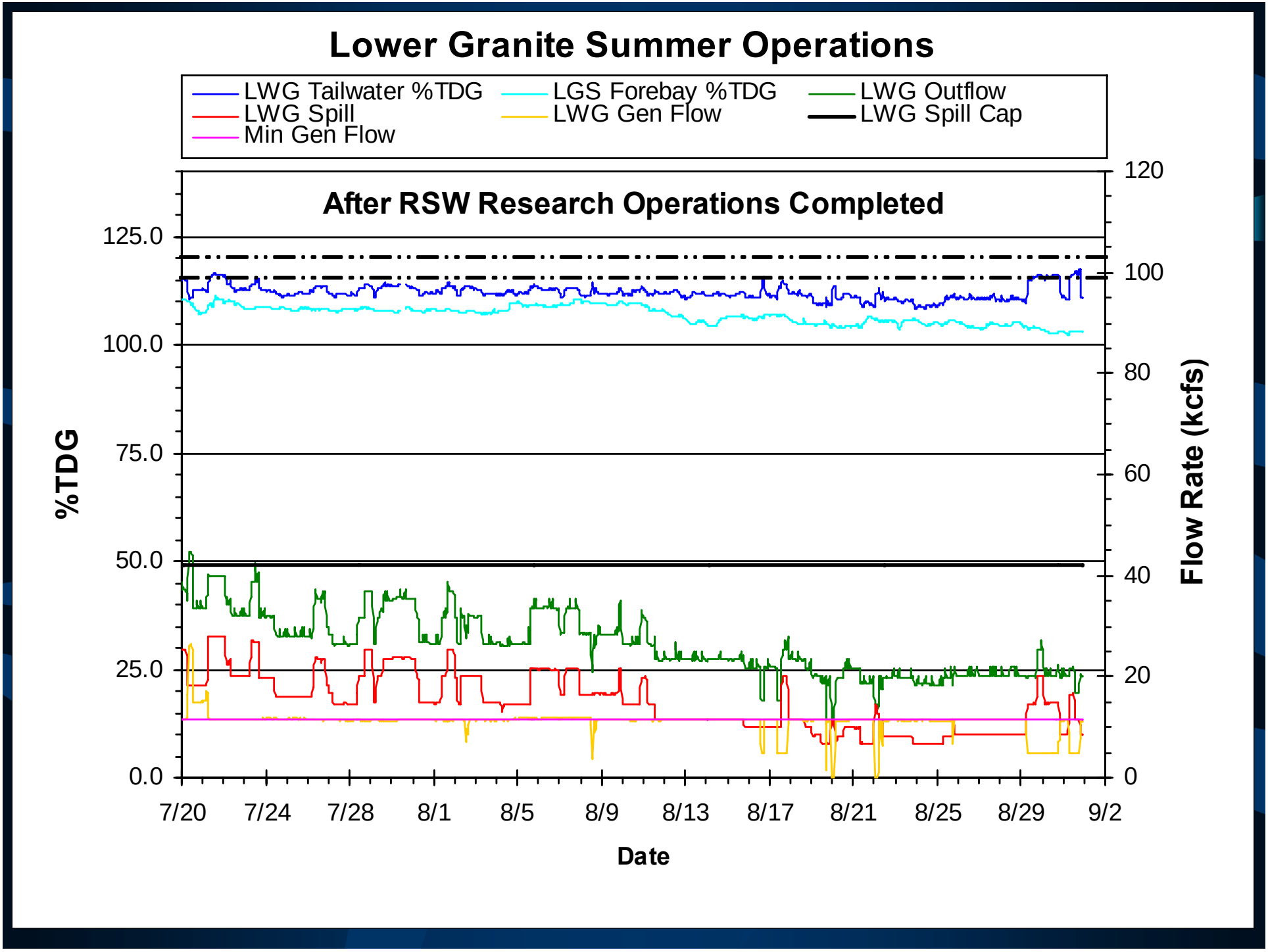
AVERAGE HIGH 12 HR %TDG EXCEEDANCES AT FMS FROM 1999 - 2005								
	2005	2004	2003	2002	2001	2000	1999	Totals
Water Quality Gages	**Qty.**	**Qty.**	**Qty.**	**Qty.**	**Qty.**	**Qty.**	**Qty.**	**Qty.**
Lower Granite Forebay *	0	0	0	0	5	2	0	7
Lower Granite Tailwater	0	0	15	17	0	4	15	51
Little Goose Forebay *	0	3	10	17	0	2	39	71
Little Goose Tailwater	0	0	6	6	0	9	6	27
Lower Monumental Forebay *	6	1	19	49	0	28	44	147
Lower Monumental Tailwater	7	1	10	6	0	12	26	62
Ice Harbor Forebay *	3	4	35	24	0	34	44	144
Ice Harbor Tailwater	3	2	4	6	0	4	12	31
McNary Forebay - Wa. *	8	10	24	43	1	14	22	122
McNary Forebay - Or.	11	23	32	45	5	22	19	157
McNary Tailwater	1	7	12	31	0	17	50	118
John Day Forebay	2	0	10	11	0	1	8	32
John Day Tailwater	3	0	0	29	0	12	43	87
The Dalles Forebay	6	5	11	18	0	5	1	46
The Dalles Tailwater	0	0	4	11	0	5	5	25
Bonneville Forebay	3	1	17	30	0	14	19	84
Cascade Island	0	---	---	---	---	---	---	0
Warrendale	---	0	1	19	0	6	2	28
Camas/Washougal	16	14	33	65	2	58	51	239
Total Number of Exceedances	**69**	**71**	**243**	**427**	**13**	**249**	**406**	**1478**

* New Forebay gages set at 15 m depth. Previous gage set at 5 m depth.

Lower Granite Spill Activities in 2005

- No Spring Spill (3 April – 19 June)
  - Seasonal Average Regulated Inflow at LWG Forecasted < 70 kcfs (2004 BiOp).
- Court Ordered Summer Spill (20 June – 31 August)
  - Non-RSW Spill
    - Operate Turbine Unit 3 at the Low End of 1% of Peak Efficiency Range.
    - Spill Remaining Flow Up To Gas Cap 24-hrs per day.
    - Initial Gas Cap set at 40 kcfs.
  - RSW Spill
    - Operate Turbine Unit 3 at Low End of 1% Peak Efficiency Range.
    - Operate RSW on Spill Bay #1 with Distributed Spill on other spill bays.
    - Alternate RSW and Non-RSW Spill Operations.
    - Spill at least 1.7 kcfs
    - RSW Spill Ended 20 July.


Lower Granite Summer Operations
LWG Tailwater %TDG
LGS Forebay %TDG
LWG Outflow
LWG Spill
LWG Gen Flow
LWG Spill Cap
Min Gen Flow
During RSW Research Operations
%TDG
Flow Rate (kcfs)
125.0
100.0
75.0
50.0
25.0
0.0
120
100
80
60
40
20
0
6/19
6/23
6/27
7/1
7/5
7/9
7/13
7/17
7/21
Date


Lower Granite Summer Operations
LWG Tailwater %TDG
LGS Forebay %TDG
LWG Outflow
LWG Spill
LWG Gen Flow
LWG Spill Cap
Min Gen Flow
After RSW Research Operations Completed
%TDG
Flow Rate (kcfs)
125.0
100.0
75.0
50.0
25.0
0.0
120
100
80
60
40
20
0
7/20
7/24
7/28
8/1
8/5
8/9
8/13
8/17
8/21
8/25
8/29
9/2
Date

Lower Granite Spill Stats 2005

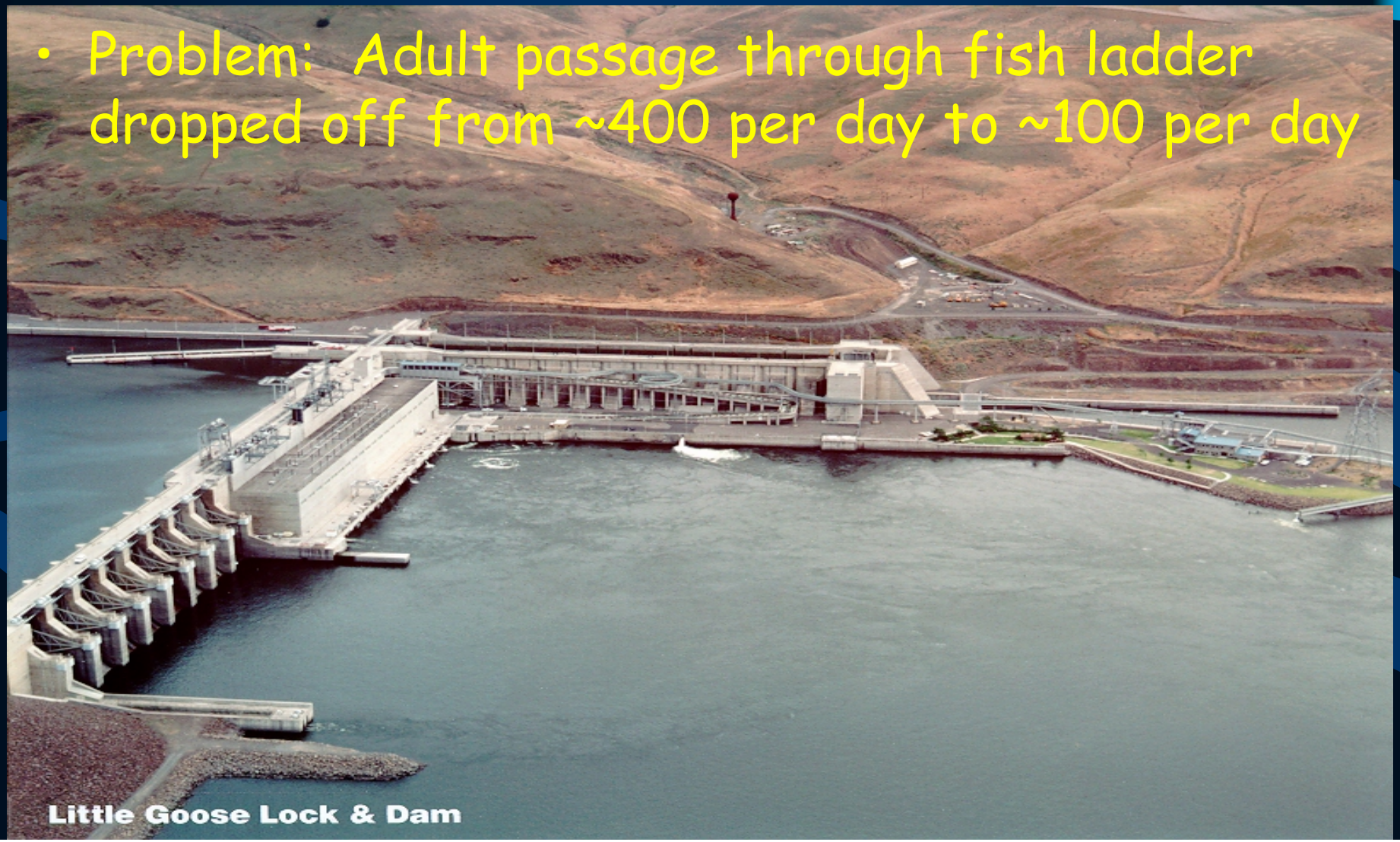
Parameter	Spring (1 Apr – 19 Jun)	Summer (20 Jun – 31 Aug)	Entire Season
Ave. Spill (kcfs)	5.7	19.3	12.2
Ave. Outflow (kcfs)	65.8	33.7	50.4
Ave. Gen Flow (kcfs)	59.6	13.9	37.8
Volume Spill (KAF)	904	2787	3690
# Hrs Spilled to Cap (hrs)	15	114	12994
% Hrs Spilled to Cap (%)	0.8	6.5	3.5
Ave. TW %TDG When Spill to Cap (%)	116.0	118.5	118.2
# Hrs Spilled Above Cap (hrs)	94	0	94
No. High 12-hr %TDG Exceedances			
Lower Granite Forebay (LWG)	0	0	0
Lower Granite Tailwater (LGNW)	0	0	0
Little Goose Forebay (LGSA)	0	0	0

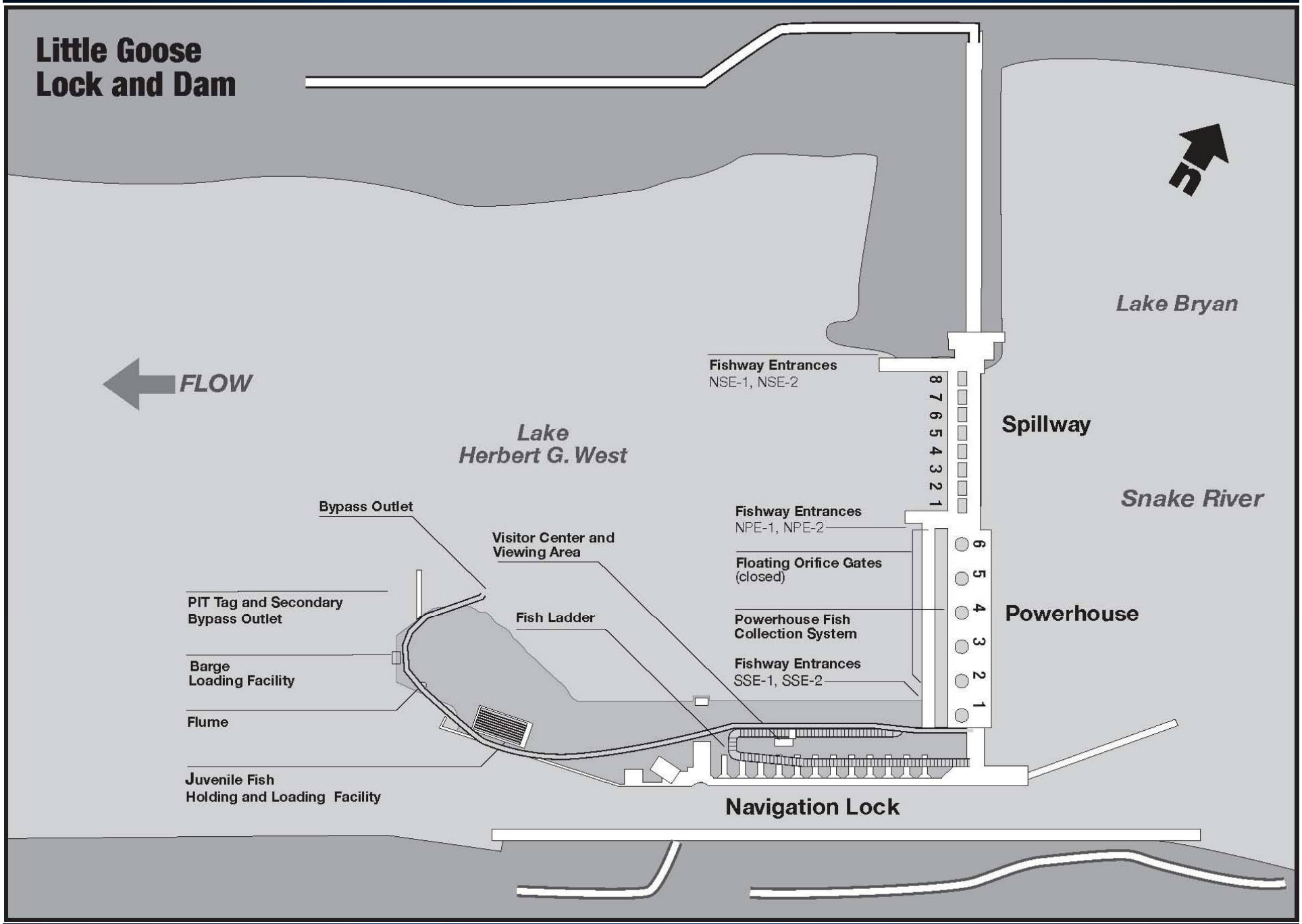
Little Goose Spill Activities in 2005

- No Spring Spill (3 April – 19 June)
  - Seasonal Average Regulated Inflow at LWG Forecasted < 70 kcfs (2004 BiOp).
- Court Ordered Summer Spill (20 June – 31 August)
  - Operate One Turbine Unit at the Low End of 1% of Peak Efficiency Range.
  - Spill Remaining Flow Up To Gas Cap 24-hrs per day.
  - Initial Gas Cap set at 40 kcfs.

Little Goose Spill Activities in 2005

- Problem: Adult passage through fish ladder dropped off from ~400 per day to ~100 per day




Little Goose
Lock and Dam
Lake Bryan
FLOW
Fishway Entrances
NSE-1, NSE-2
8 7 6 5 4 3 2 1
Spillway
Lake
Herbert G. West
Snake River
Bypass Outlet
Visitor Center and
Viewing Area
Fishway Entrances
NPE-1, NPE-2
Floating Orifice Gates
(closed)
6 5 4 3 2 1
Powerhouse
PIT Tag and Secondary
Bypass Outlet
Fish Ladder
Powerhouse Fish
Collection System
Barge
Loading Facility
Fishway Entrances
SSE-1, SSE-2
Flume
Juvenile Fish
Holding and Loading Facility
Navigation Lock

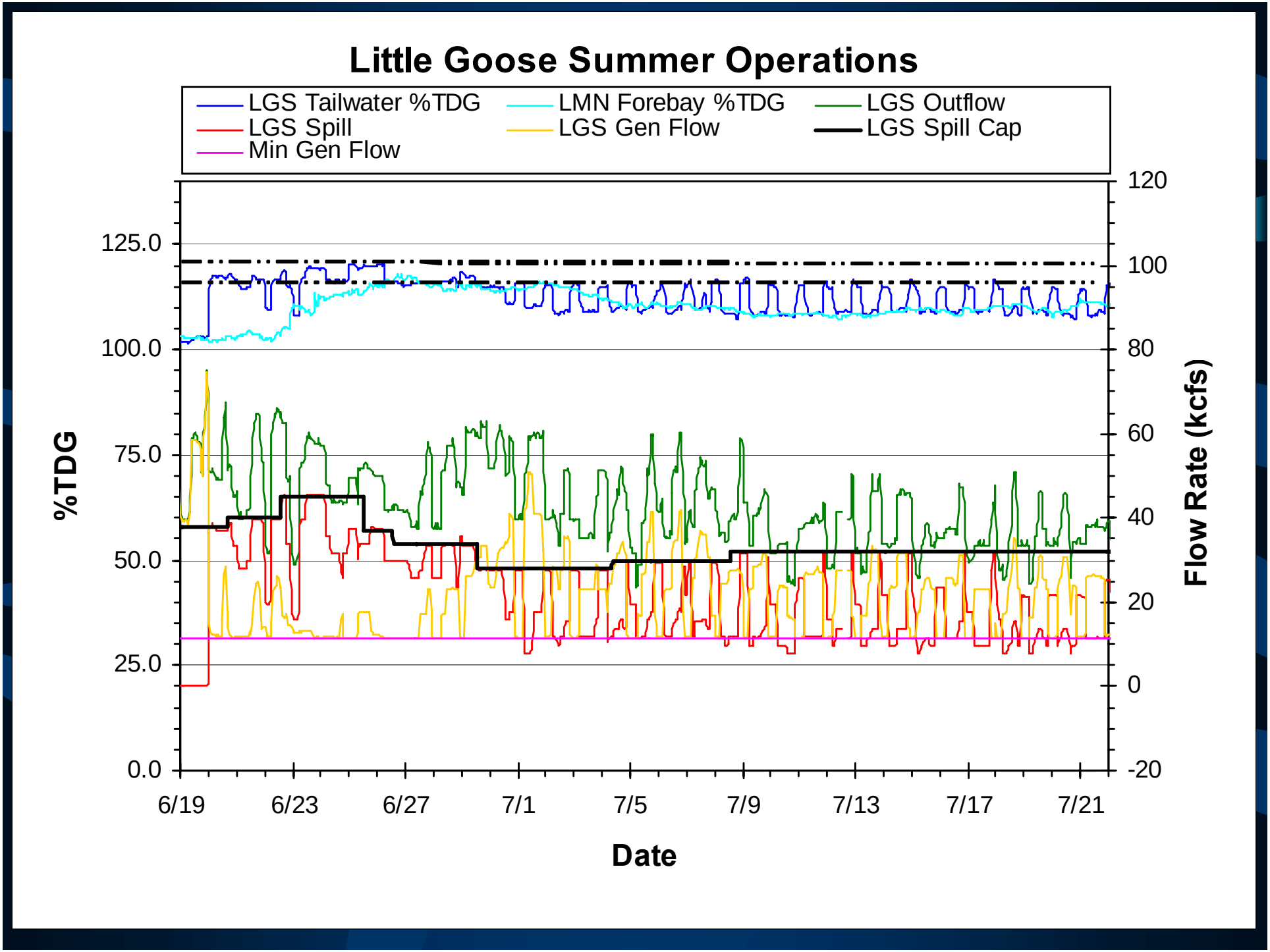
Little Goose Spill Activities in 2005

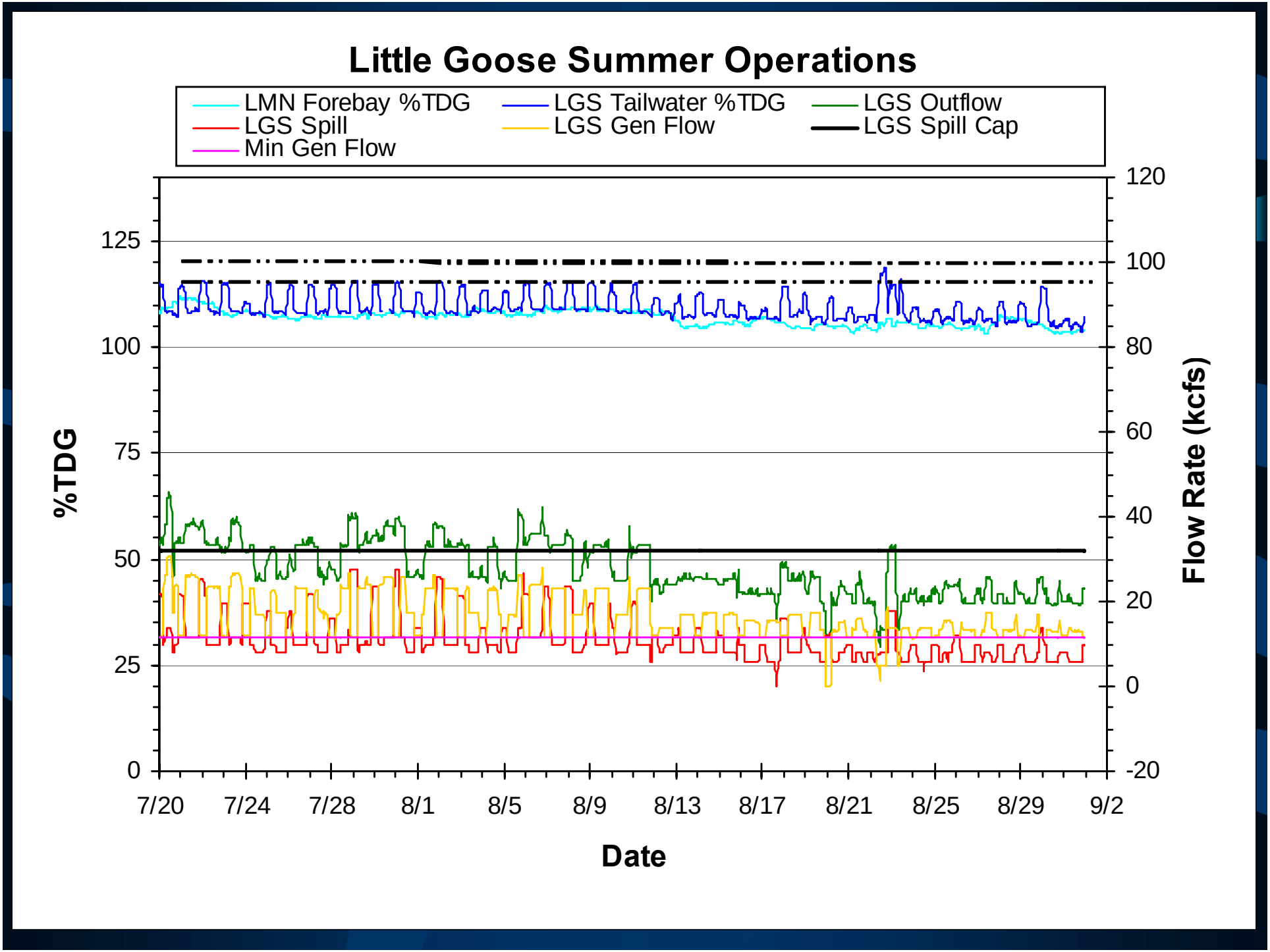
- Spill Modification #1: Daytime Spill (0600-1800 hrs) Operate Turbine Unit 2 at the High End of 1% of Peak Efficiency Range when flows > 43.4 kcfs, Spill Remaining Flow. Also, change "flat spill" to "crowned spill."
- Spill Modification #2: Daytime Spill (0500-2000 hrs) for flows <35.5 kcfs, Operate Turbine Unit 2, 50% Spill/50% Generation, keep "crowned spill" pattern. For flows > 35.5, operate two turbine units, 50% Spill/50% Generation, keep "crowned spill" pattern.

Little Goose Spill Activities in 2005

- Spill Modification #3: Daytime Spill (0500-2100 hrs, spill 30% of total outflow. Keep "crowned spill" pattern.

- Adult passage "spiked" on 30 June to ~1770.


Little Goose Summer Operations
LGS Tailwater %TDG
LMN Forebay %TDG
LGS Outflow
LGS Spill
LGS Gen Flow
LGS Spill Cap
Min Gen Flow
%TDG
Flow Rate (kcfs)
125.0
100.0
75.0
50.0
25.0
0.0
120
100
80
60
40
20
0
-20
6/19
6/23
6/27
7/1
7/5
7/9
7/13
7/17
7/21
Date


Little Goose Summer Operations
LMN Forebay %TDG
LGS Tailwater %TDG
LGS Outflow
LGS Spill
LGS Gen Flow
LGS Spill Cap
Min Gen Flow
%TDG
Flow Rate (kcfs)
Date
125
100
75
50
25
0
120
100
80
60
40
20
0
-20
7/20
7/24
7/28
8/1
8/5
8/9
8/13
8/17
8/21
8/25
8/29
9/2

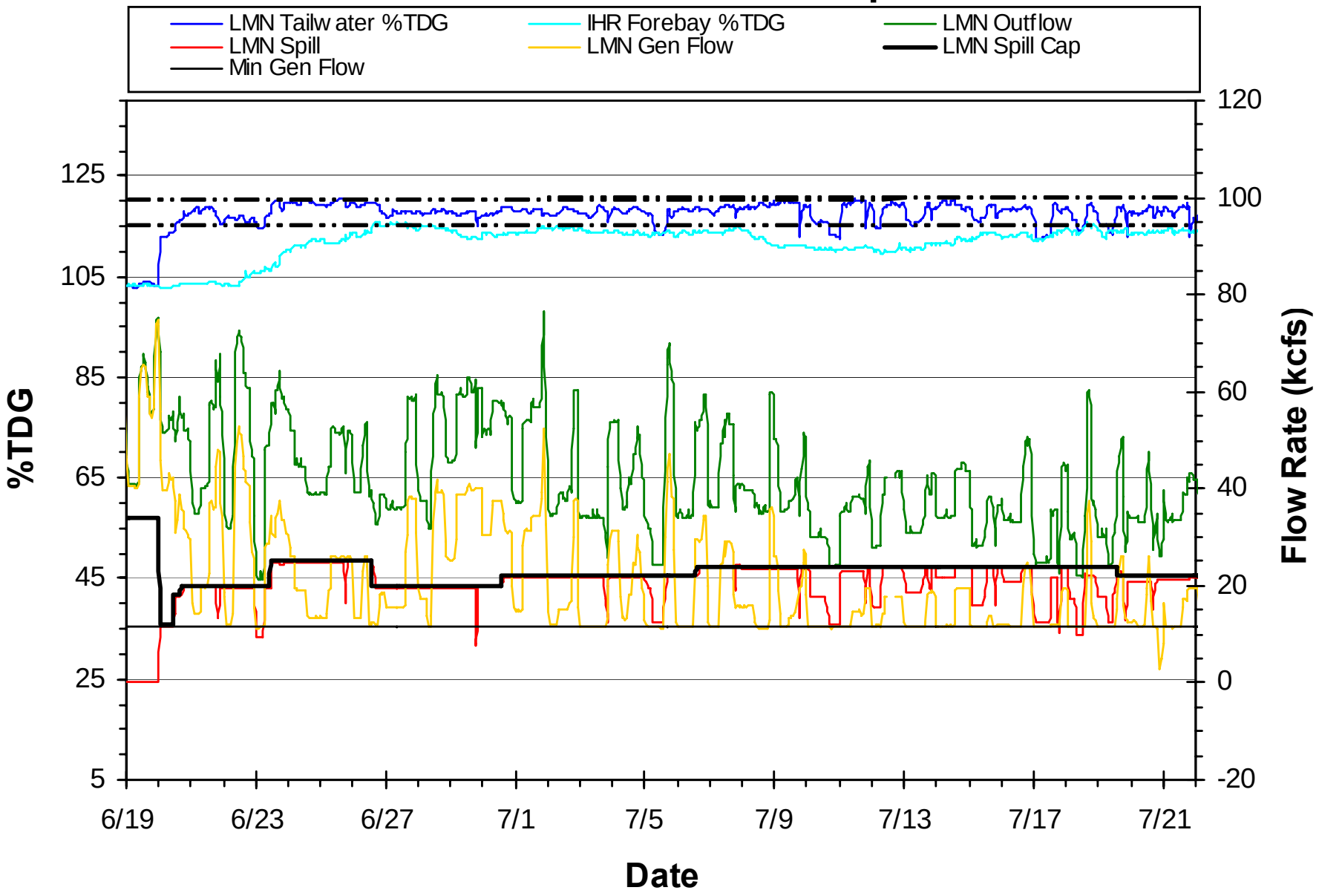
Little Goose Spill Stats 2005

Parameter	Spring (1 Apr – 19 Jun)	Summer (20 Jun – 31 Aug)	Entire Season
Ave. Spill (kcfs)	1.3	15.5	8.1
Ave. Outflow (kcfs)	65.1	34.1	50.3
Ave. Gen Flow (kcfs)	63.1	18.0	41.6
Volume Spill (KAF)	206.4	2,244	2,451
# Hrs Spilled to Cap (hrs)	10	193	203
% Hrs Spilled to Cap (%)	0.5	11.0	5.5
Ave. TW %TDG When Spill to Cap (%)	116.2	116.4	116.4
# Hrs Spilled Above Cap (hrs)	0	4	4
No. High 12-hr %TDG Exceedances			
Little Goose Forebay (LGSA)	0	0	0
Little Goose Tailwater (LGSW)	0	0	0
Lower Monumental Forebay (LMNA)	0	6	6

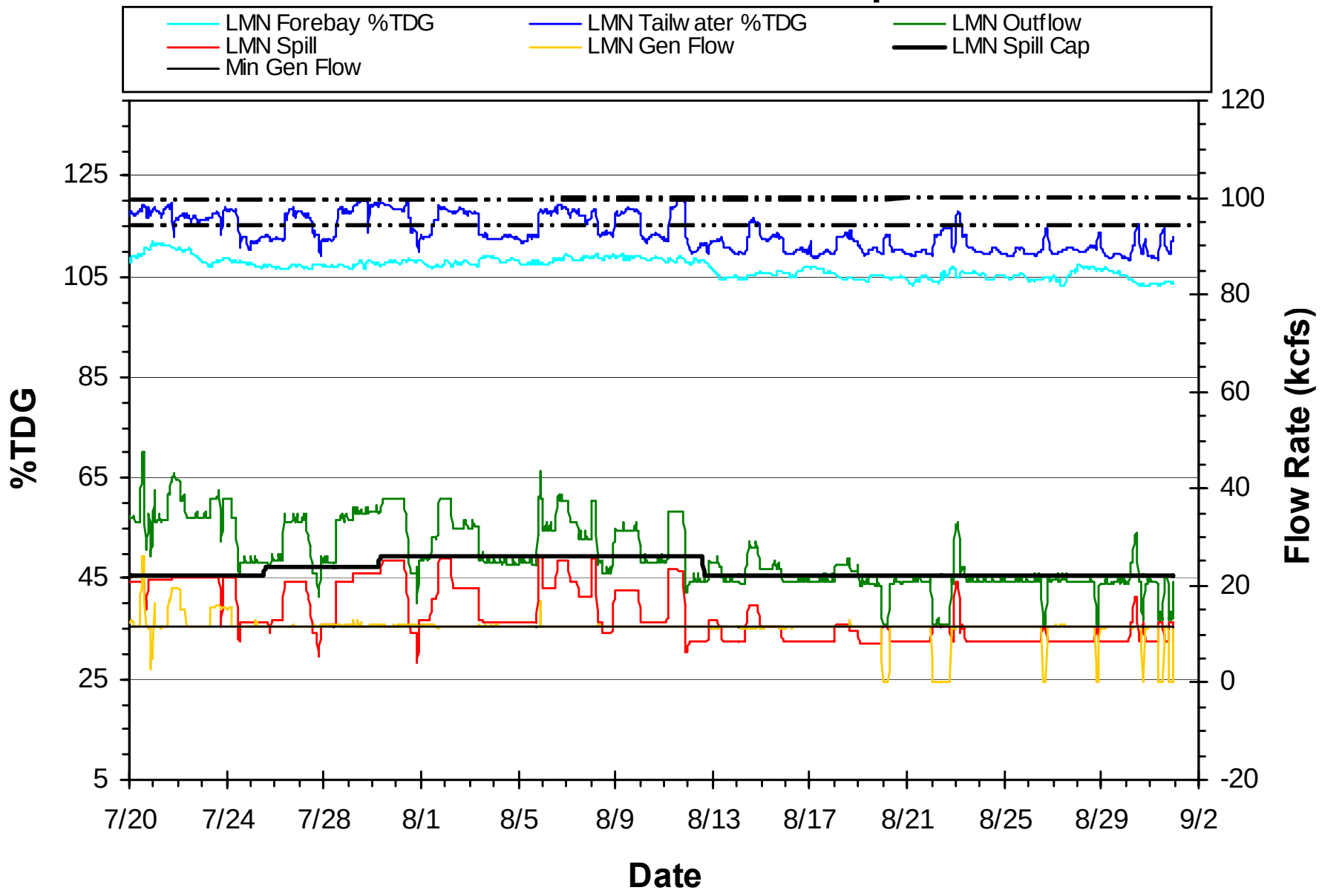
Lower Monumental Spill Activities in 2005

- No Spring Spill (3 April – 19 June)
  - Seasonal Average Regulated Inflow at LWG Forecasted < 70 kcfs (2004 BiOp).
- Court Ordered Summer Spill (20 June – 31 August)
  - Operate One Turbine Unit at the Low End of 1% of Peak Efficiency Range.
  - Spill Remaining Flow Up To Gas Cap 24-hrs per day.
  - Initial Gas Cap set at 12 kcfs.
  - In response to requests by plaintiffs, spill cap increased to 18, then to 20 kcfs on 20 June and to 25 kcfs on 23 June.

Lower Monumental Summer Operations



Lower Monumental Summer Operations



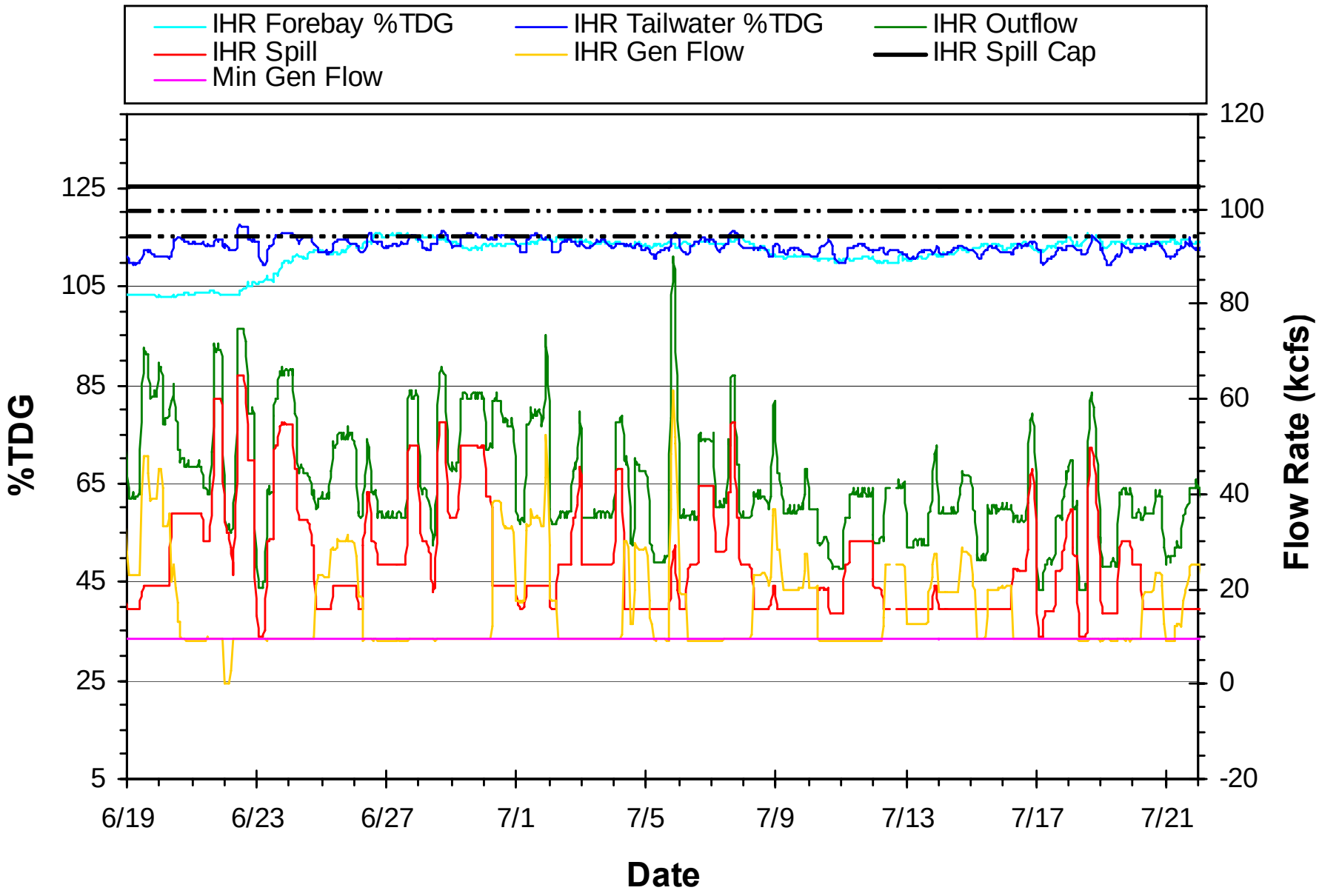
Lower Monumental Spill Stats 2005

Parameter	Spring (1 Apr – 19 Jun)	Summer (20 Jun – 31 Aug)	Entire Season
Ave. Spill (kcfs)	4.0	16.8	10.1
Ave. Outflow (kcfs)	67.0	32.8	50.7
Ave. Gen Flow (kcfs)	62.2	15.1	39.7
Volume Spill (KAF)	638	2,436	3,074
# Hrs Spilled to Cap (hrs)	31	651	682
% Hrs Spilled to Cap (%)	1.6	37.2	18.6
Ave. TW %TDG When Spill to Cap (%)	121	118.3	118.4
# Hrs Spilled Above Cap (hrs)	56	6	62
No. High 12-hr %TDG Exceedances			
Lower Monumental Forebay (LMNA)	0	6	6
Lower Monumental Tailwater (LMNW)	6	1	7
Lower Monumental Forebay (IHRA)	0	3	3

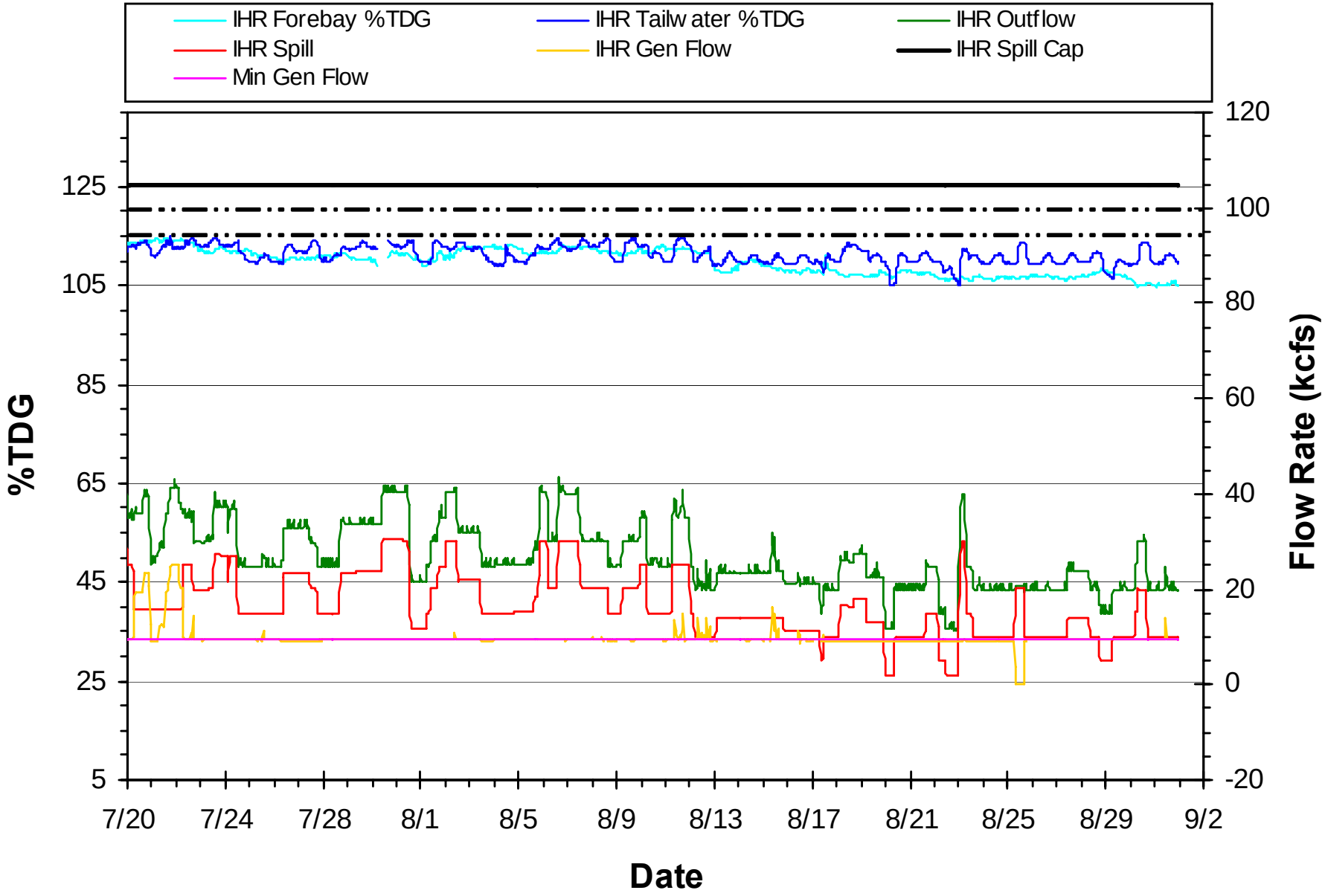
Ice Harbor Spill Activities in 2005

- Spring Spill (2004 BiOp Criteria)
  - Daytime (0500-1800 hrs), spill 45 kcfs
  - Nighttime (1800-0500 hrs), Spill to Gas Cap.
- Court Ordered Summer Spill (20 June – 31 August)
  - Operate One Turbine Unit at the Low End of 1% of Peak Efficiency Range.
  - Spill Remaining Flow Up To Gas Cap 24-hrs per day.
  - Initial Gas Cap set at 105 kcfs.
  - Periodic RSW testing operations.

Ice Harbor Summer Operations



Ice Harbor Summer Operations

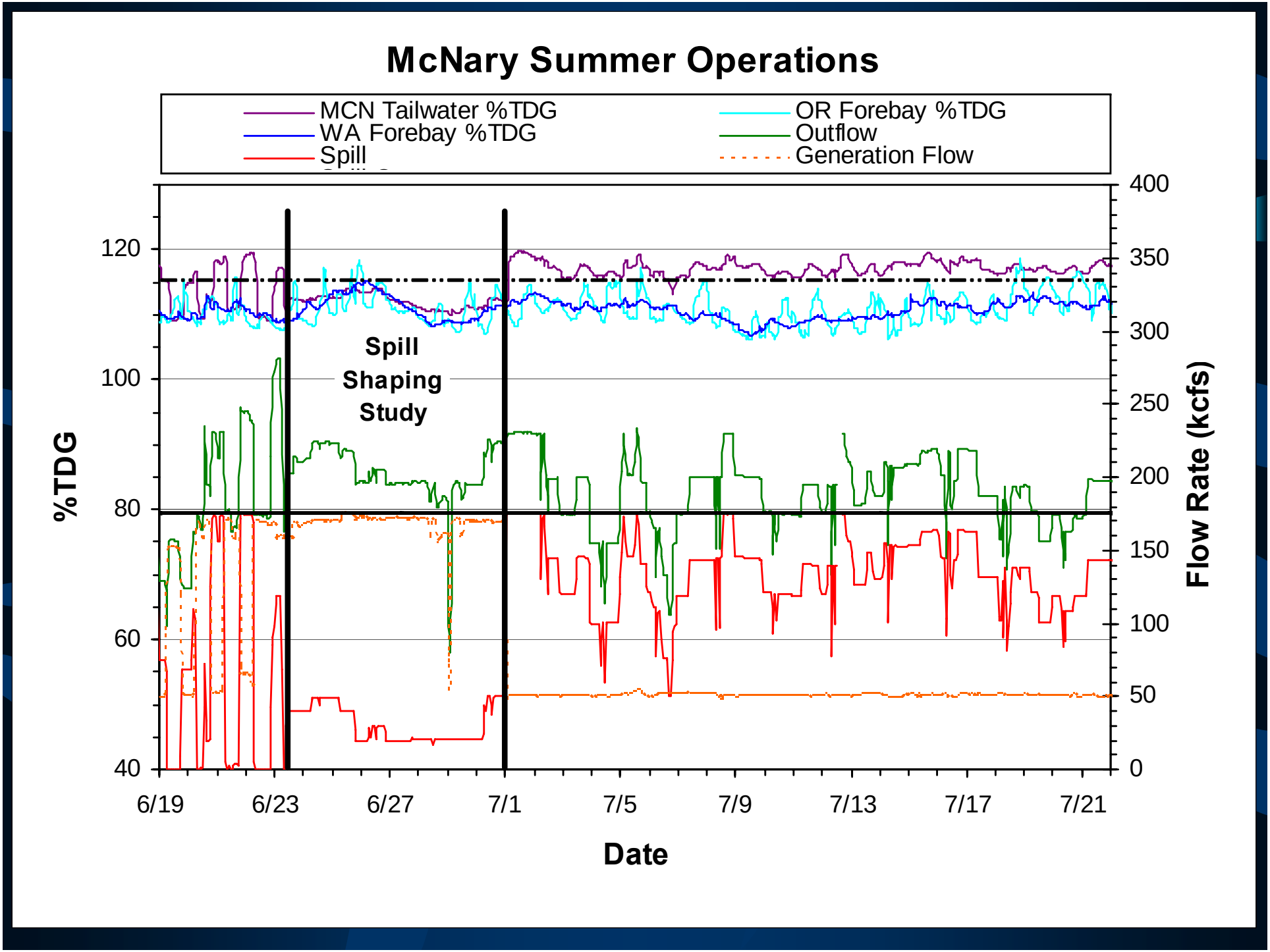


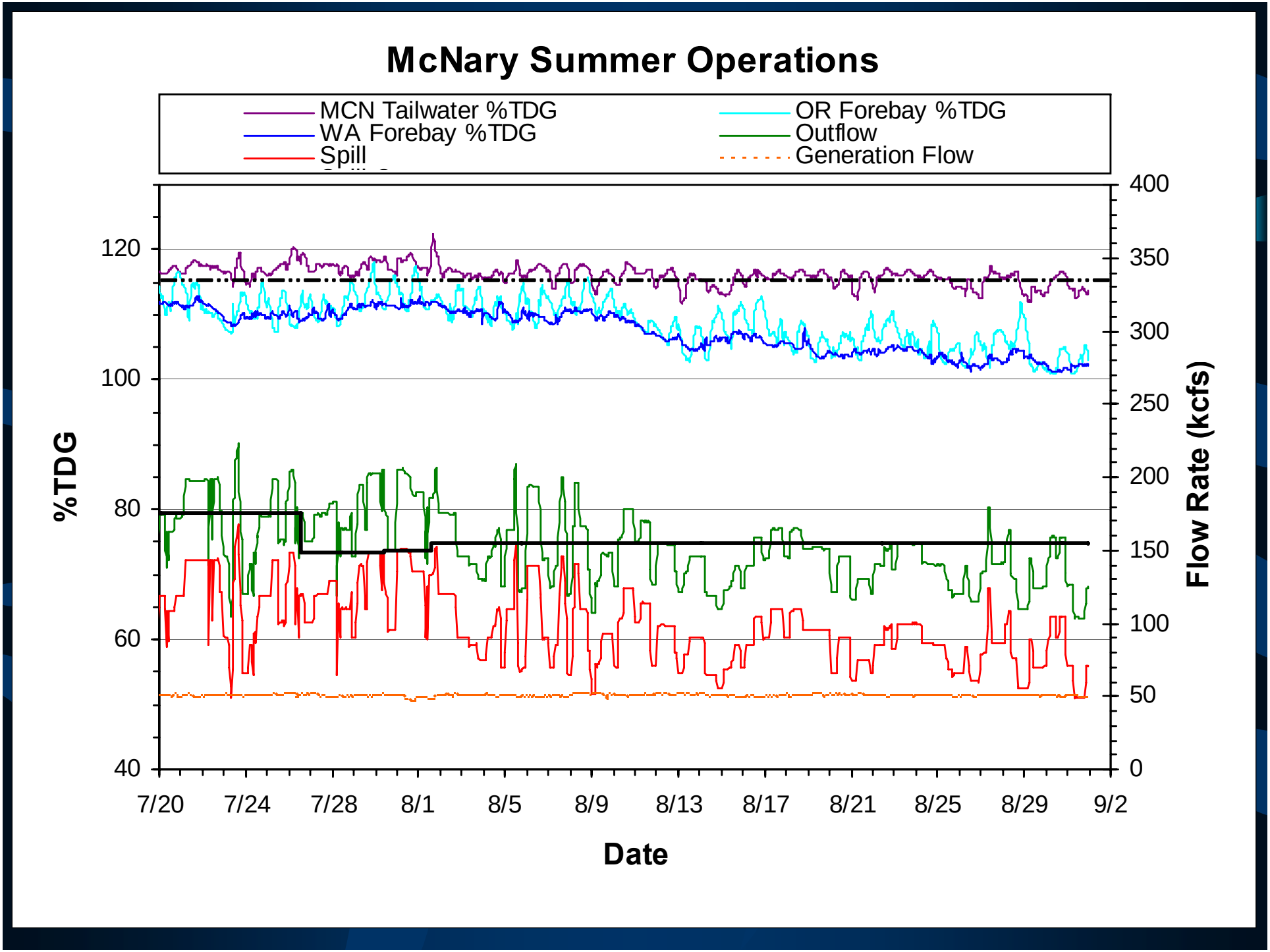
Ice Harbor Spill Stats 2005

Parameter	Spring (1 Apr – 19 Jun)	Summer (20 Jun – 31 Aug)	Entire Season
Ave. Spill (kcfs)	38.7	20.5	30.0
Ave. Outflow (kcfs)	68.1	33.3	51.5
Ave. Gen Flow (kcfs)	28.5	11.9	20.6
Volume Spill (KAF)	6,129	2,964	9,093
# Hrs Spilled to Cap (hrs)	216	0	216
% Hrs Spilled to Cap (%)	11.3	0.0	5.9
Ave. TW %TDG When Spill to Cap (%)	119.4	N/A	119.4
# Hrs Spilled Above Cap (hrs)	0	0	0
No. High 12-hr %TDG Exceedances			
Ice Harbor Forebay (IHRA)	0	3	3
Ice Harbor Tailwater (IDSW)	3	0	3

McNary Spill Activities in 2005

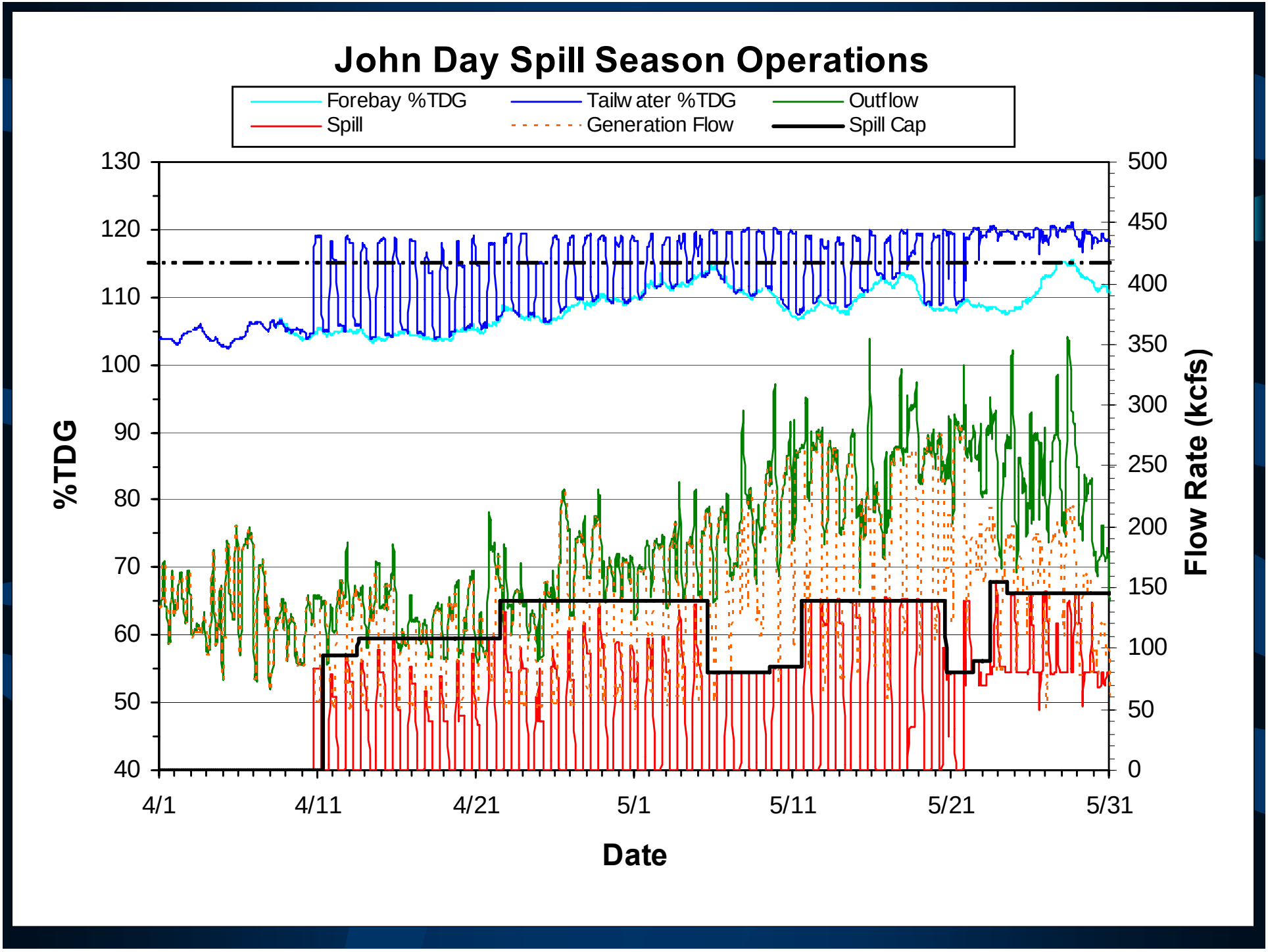
- Spring Spill (2004 BiOp Criteria)
  - Daytime (0500-1800 hrs), No Spill
  - Nighttime (1800-0500 hrs), Spill to Gas Cap.
- Court Ordered Summer Spill (1 July – 31 August)
  - Operate One Turbine @ 50 kcfs at all times.
  - Spill Remaining Flow Up To Gas Cap 24-hrs per day.
  - Initial Gas Cap set at 175 kcfs.

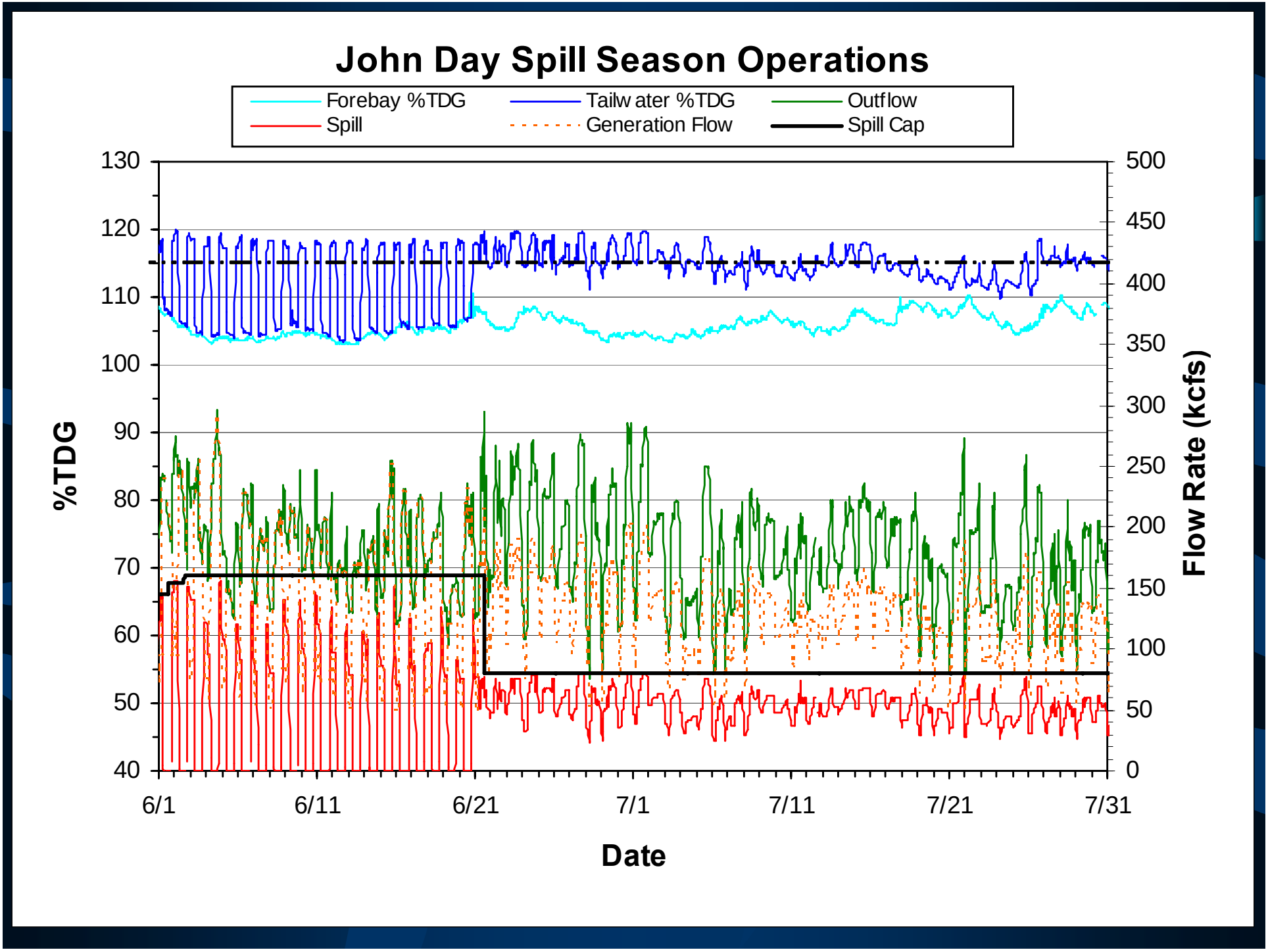

McNary Summer Operations
MCN Tailwater %TDG
WA Forebay %TDG
Spill
OR Forebay %TDG
Outflow
Generation Flow
Spill
Shaping
Study
%TDG
Flow Rate (kcfs)
Date
120
100
80
60
40
400
350
300
250
200
150
100
50
0
6/19
6/23
6/27
7/1
7/5
7/9
7/13
7/17
7/21

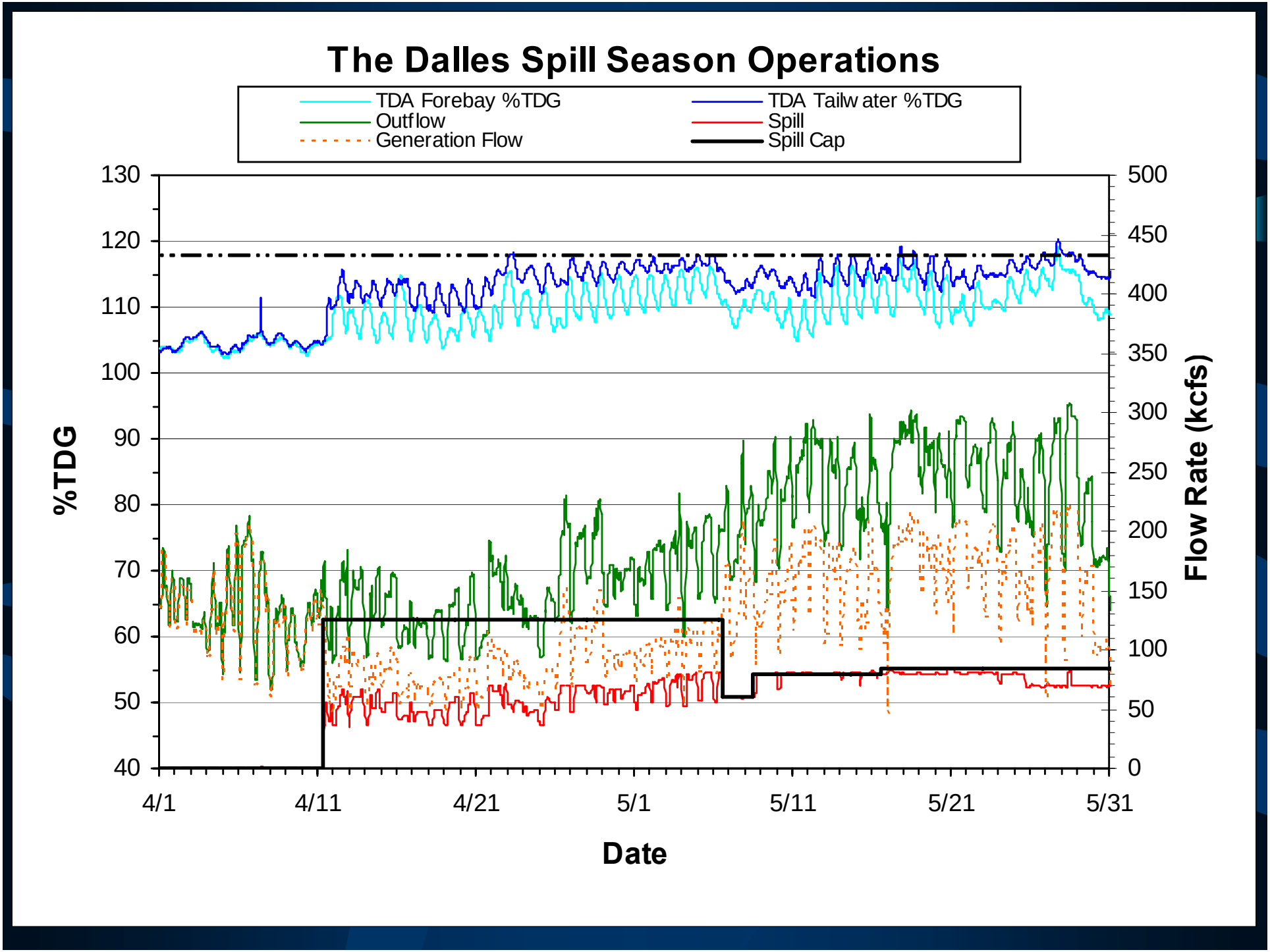

McNary Summer Operations
MCN Tailwater %TDG
WA Forebay %TDG
Spill
OR Forebay %TDG
Outflow
Generation Flow
%TDG
120
100
80
60
40
Flow Rate (kcfs)
400
350
300
250
200
150
100
50
0
7/20
7/24
7/28
8/1
8/5
8/9
8/13
8/17
8/21
8/25
8/29
9/2
Date

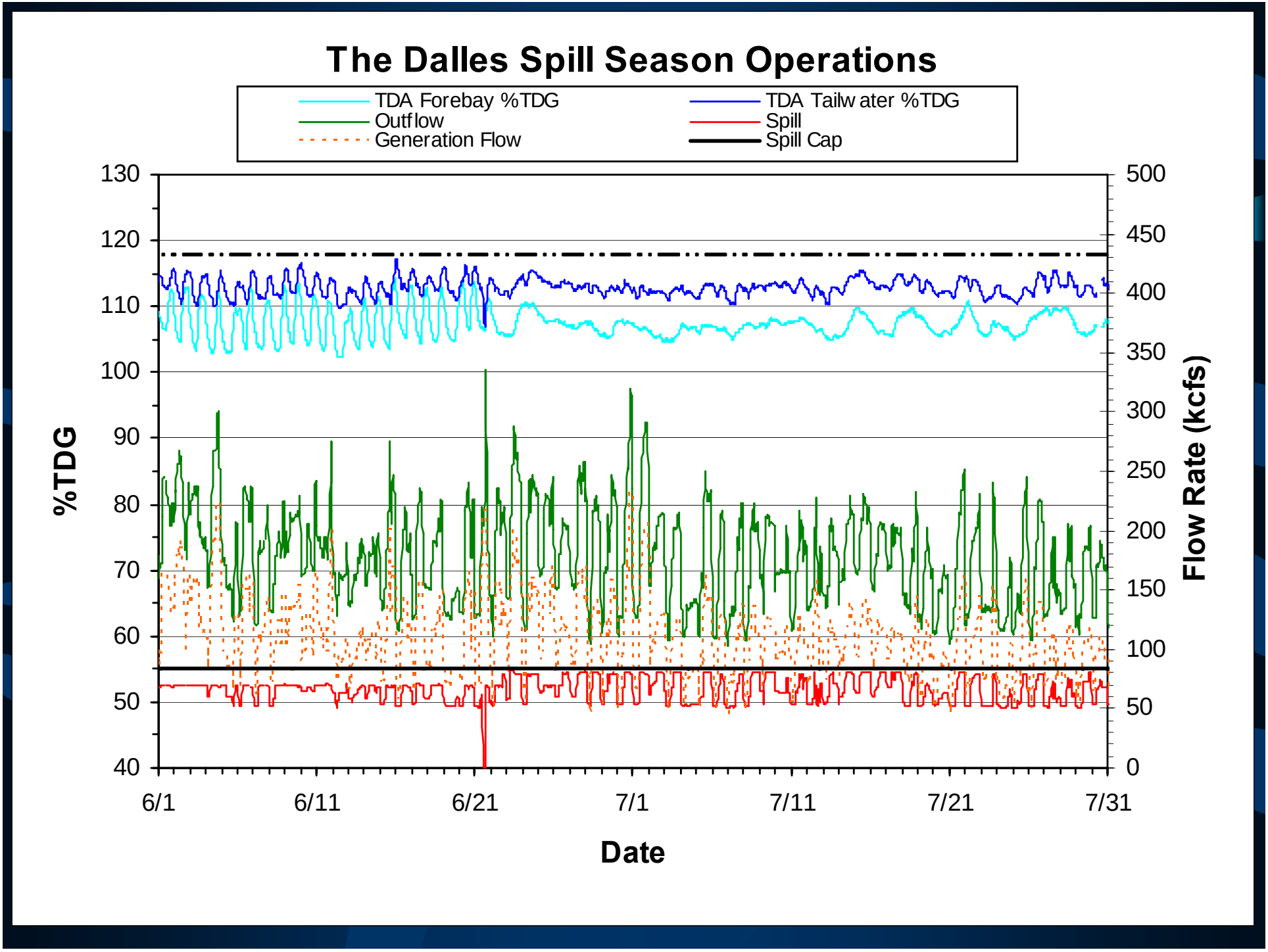
McNary Spill Stats 2005

Parameter	Spring (1 Apr – 19 Jun)	Summer (20 Jun – 31 Aug)	Entire Season
Ave. Spill (kcfs)	65.0	110.0	83.2
Ave. Outflow (kcfs)	189.5	165.0	179.5
Ave. Gen Flow (kcfs)	119.8	66.0	91.6
Volume Spill (KAF)	10,769.3	13,485.9	25,201.8
# Hrs Spilled to Cap (hrs)	240	91	331
% Hrs Spilled to Cap (%)	11.0	6.1	9.0
Ave. TW %TDG When Spill to Cap (%)	118.3	118.4	118.3
# Hrs Spilled Above Cap (hrs)	65	0	65
No. High 12-hr %TDG Exceedances			
McNary Forebay (MCNA)	8	0	8
McNary Forebay (MCQO)	6	5	11
McNary Tailwater (MCPW)	1	0	1

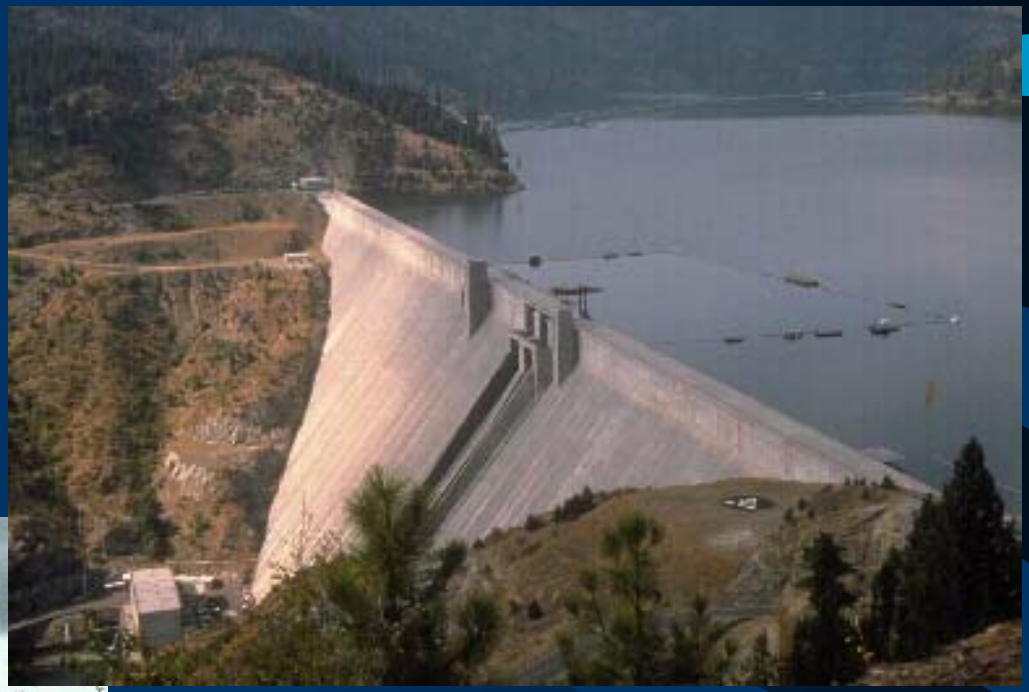

John Day Spill Season Operations
Forebay %TDG
Tailwater %TDG
Outflow
Spill
Generation Flow
Spill Cap
%TDG
Flow Rate (kcfs)
Date
130
120
110
100
90
80
70
60
50
40
500
450
400
350
300
250
200
150
100
50
0
4/1
4/11
4/21
5/1
5/11
5/21
5/31


John Day Spill Season Operations
Forebay %TDG
Tailwater %TDG
Outflow
Spill
Generation Flow
Spill Cap
%TDG
Flow Rate (kcfs)
130
120
110
100
90
80
70
60
50
40
500
450
400
350
300
250
200
150
100
50
0
6/1
6/11
6/21
7/1
7/11
7/21
7/31
Date


The Dalles Spill Season Operations
TDA Forebay %TDG
TDA Tailwater %TDG
Outflow
Spill
Generation Flow
Spill Cap
%TDG
Flow Rate (kcfs)
Date
130
120
110
100
90
80
70
60
50
40
500
450
400
350
300
250
200
150
100
50
0
4/1
4/11
4/21
5/1
5/11
5/21
5/31


The Dalles Spill Season Operations
TDA Forebay %TDG
TDA Tailwater %TDG
Outflow
Spill
Generation Flow
Spill Cap
%TDG
Flow Rate (kcfs)
Date
130
120
110
100
90
80
70
60
50
40
500
450
400
350
300
250
200
150
100
50
0
6/1
6/11
6/21
7/1
7/11
7/21
7/31

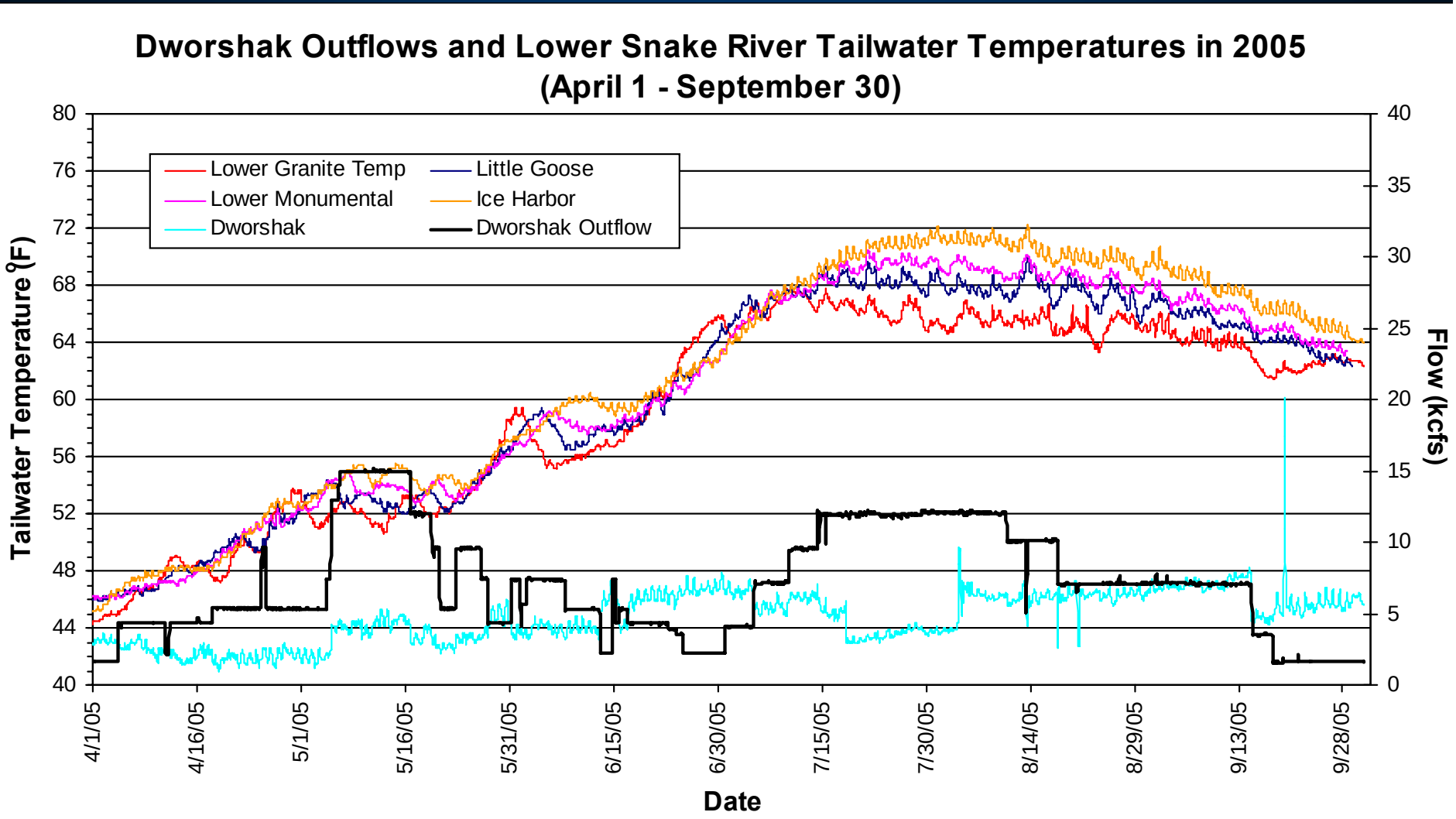
Dworshak Summer Operations



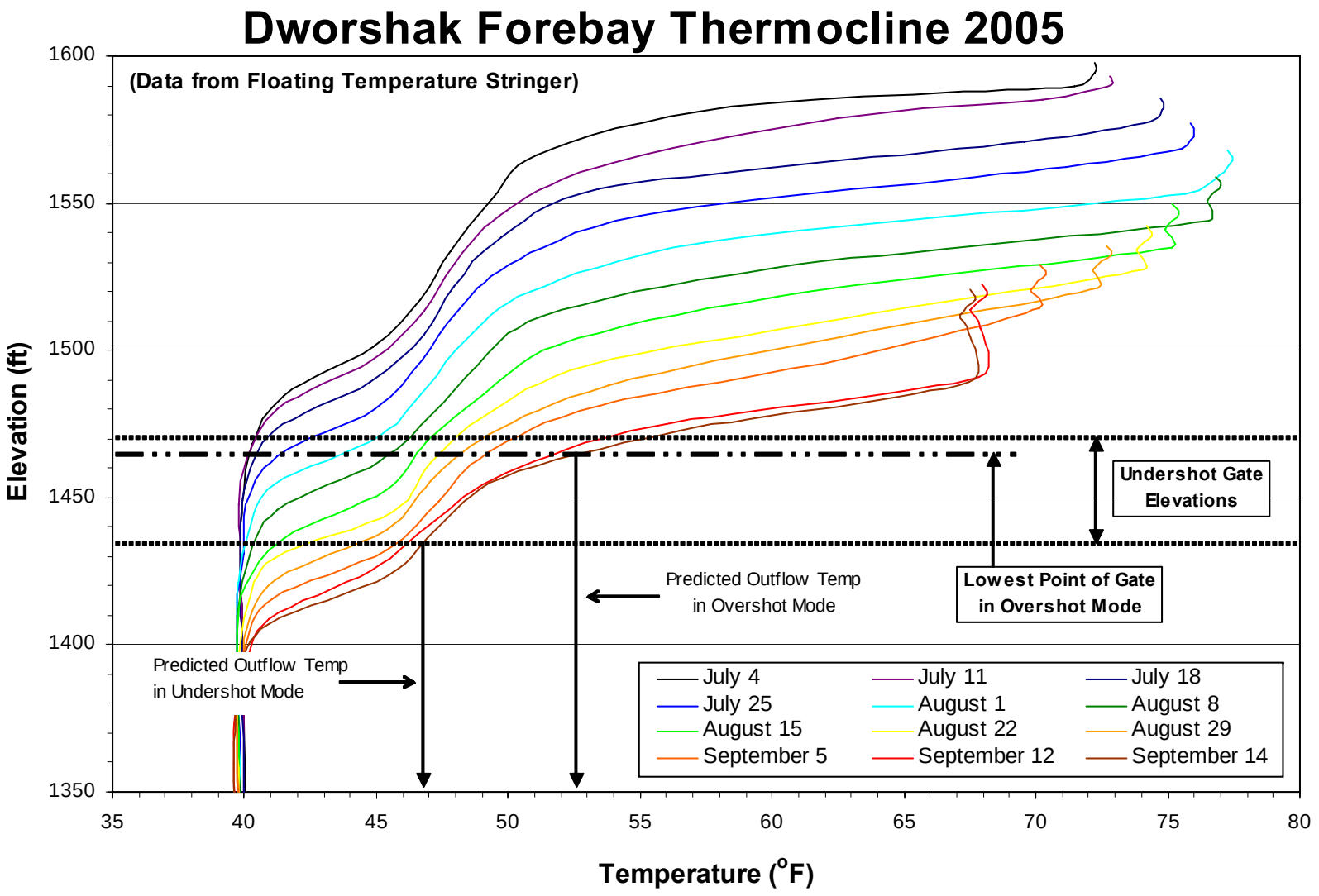
Dworshak Dam

Lower Granite Dam Tailwater

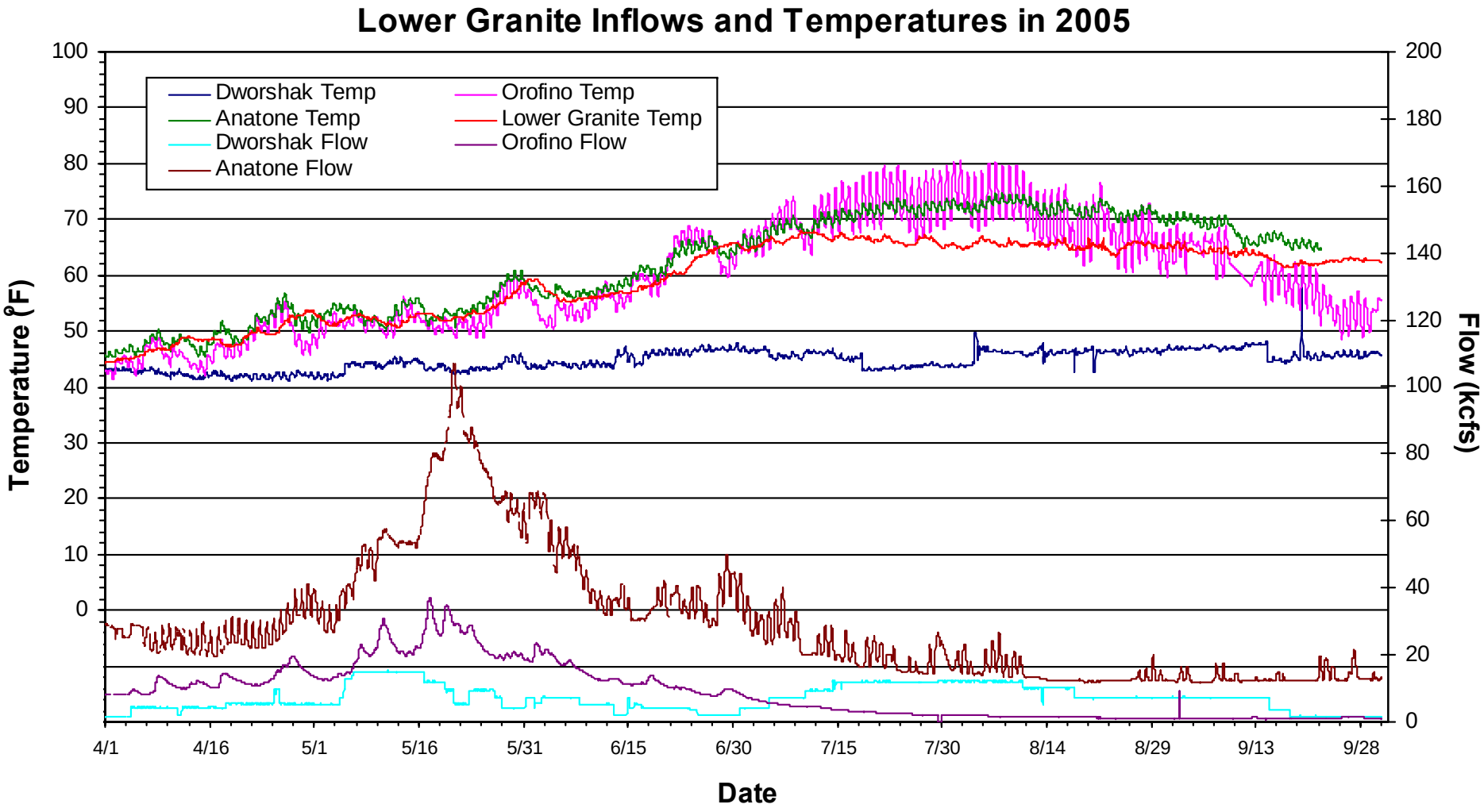
Dworshak Summer Operations



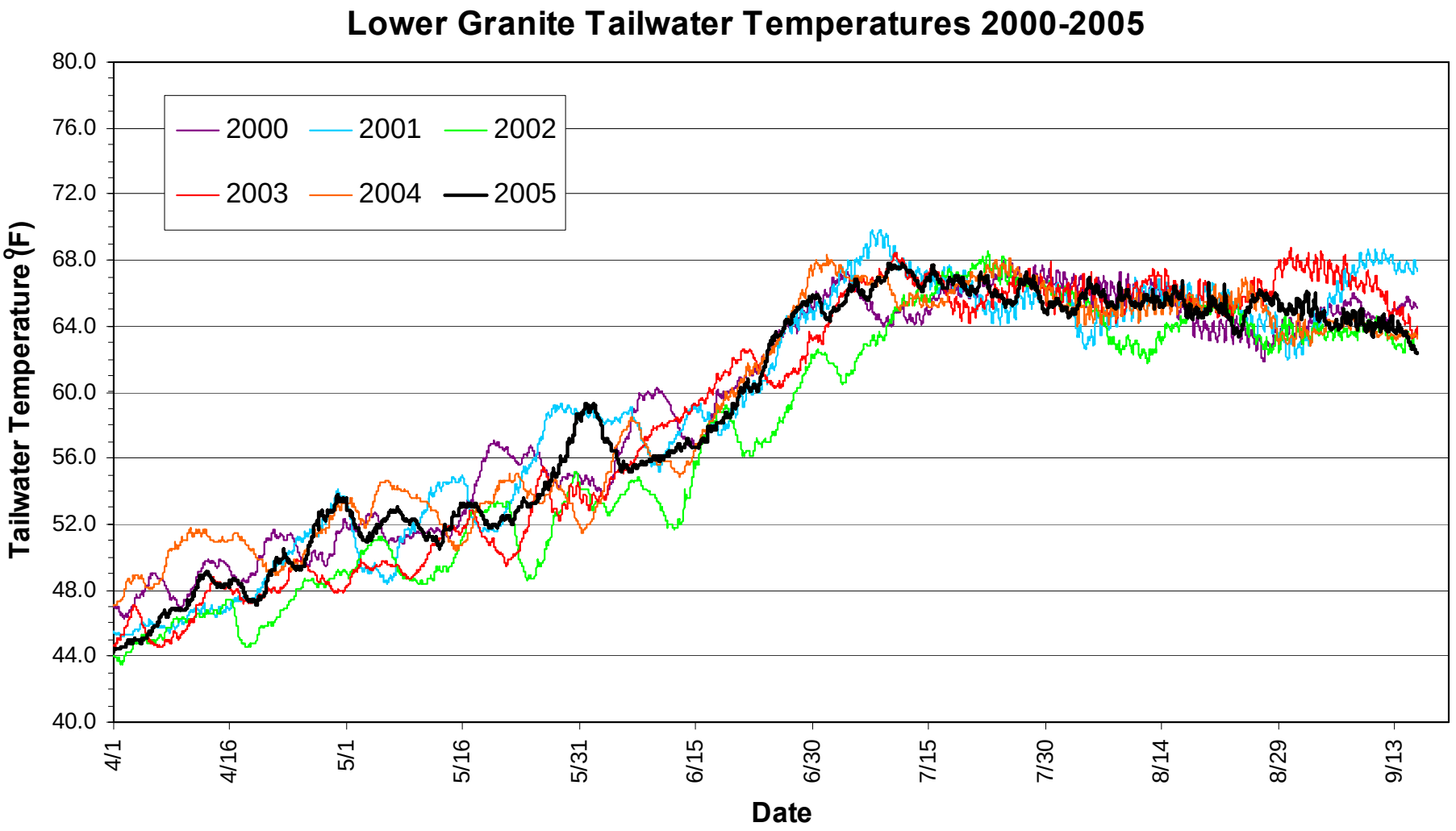
Dworshak Summer Operations



Dworshak Summer Operations



Dworshak Summer Operations



Dworshak Summer Operations

Year	Hours of Exceedance	Cumulative Magnitude of Exceedance
2005	0	0
2004	7	1
2003	63	8
2002	17	2
2001	172	68
2000	0	0
1999	23	4
1998	981	956
1997	137	31
1996	526	341
1995	593	201

11-Year Statistics

Hours of Exceedance	
Range:	Average:
High: 981 hrs (1998)	11-Yr Ave: 229 hrs
Low: 0 hrs (2000, 2005)	1995-1999: 452 hrs
	2000-2005: 43

Cumulative Magnitude of Exceedance	
Range:	Average:
High: 1,721 deg-hrs (1998)	11-Yr Ave: 264 deg-hrs
Low: 0 deg-hrs (2000, 2005)	1995-1999: 552 deg-hrs
	2000-2005: 24 deg-hrs

Cumulative Magnitude of Exceedance

$\sum$ (# hours temp exceeds 68 ^{o}F standard) x (Number of degrees above 68 ^{o}F standard)